Nutrient Management in Oil Palm Replanting

Oil palms are replanted when they are too tall for effective crop recovery, or when yields have dropped to a level where replacement with a new generation of higher yield potential becomes economic (von Uexkull et. al., 2003). In Malaysia, it is common practice to replant palms when they are 25 years old (Ooi, 2011). During the 25-year economic cycle, a large amount of nutrients are taken up by the palms to satisfy growth needs and crop production [see Goh and Härdter (2003) for details]. The nutrients used for growth are fixed in the living oil palm biomass.

When the old palms are replanted, the large pool of nutrients contained in the (previously living, now dead) biomass is released as the felled palms decompose (Table 1). In the context of IPNI's advocated 4R Nutrient Stewardship concept – right time, right place, right source, right rate – biomass from felled palms represents an additional source of nutrients that should be integrated into the system. Corley (2009) provides an estimate on the available rate of nutrients from felled palms. However, the actual amount available is likely to be even higher than shown in Table 1 when roots and the last remnants of unharvested crop are included. Unfortunately, other estimates are also very variable.

Table 1. Nutrients in palm trunks and fronds at replanting (Redshaw, 2003)

Palm part	N	P	K	Mg
	kg ha^{-1}			
Trunks	250	25	350	60
Fronds	150	15	150	30
Total	400	40	500	90

N = nitrogen; P = phosphorus; K = potassium; Mg = magnesium.

The key nutrient management issues in oil palm replanting are therefore related (a) to estimating the amount of nutrients released and minimize its loss from the agro-ecosystem (right rate), (b) to be timely in meeting the nutrient requirements of the new generation of palms (right time), and (c) to apply them where they are most effective (right place).

The zero-burn method of replanting (Hashim *et al.*, 1995) is effective in returning nutrients and organic matter (OM) contained in the felled palms to the soil. Burning leads to loss of nitrogen (N), sulphur (S) and OM, so should be avoided. When the felled biomass is chipped, decomposition occurs within 18 months resulting in improved soil physical and chemical properties (Khalid *et al.*, 1999). Losses of the released nutrients through surface wash and soil erosion is minimized by establishing a good groundcover of leguminous cover plants (LCPs) (Arif *et al.*, 2007).

The large amount of nutrients released from the felled biomass within the first year itself far exceeds the nutrient requirements of both the young palms and the LCPs combined (Corley, 2009). Thus, in theory there is no need to apply any fertilizers to the young palms in their first year. Most of the biomass nutrients are released by the second year. As the nutrient needs of the young palms starts at a low level and increases, it is likely impossible to fully match the demand by palms with supply from felled and chipped biomass. Nutrients from inorganic sources are required to meet the demands of palm growth in a timely manner.

Current conventional practices in immature oil palm fertilization such as standard applications of inorganic fertilizers and mulching with empty fruit bunches (EFB) add to the surplus of available nutrients in the first two years of the new oil palm cycle. Palm trunk chips can be used as mulching material for the young palms, replacing EFB which can then be used elsewhere. Indeed, palm trunk chips have been shown to improve the growth of young palms over EFB (Lim *et al.*, 1995). Khalid *et al.* (2002) found that unfertilized young oil palms grew better when mulched with felled palm residues that were chipped rather than pulverized, suggesting that larger sized residues had slower rates of nutrient release.

Corley (2009) has considered possible strategies to reduce the gross mismatch between available and required nutrients for young palms, including:

(a) Avoid the chipping of felled palm trunks, and instead stack whole trunks into windrows, to slow down the rate of biomass decomposition (though research is still needed to determine the rate of nutrient release from whole palm trunks);

(b) The above in combination with the establishment of a vigorous LCP to take up a proportion of the released nutrients (as well as to minimize the threat of *Oryctes rhinoceros*, a serious pest that breeds in rotting palm trunks);

(c) Adopt the underplanting method of replanting, where felling is delayed for a part of the old stand (Chia *et al.*, 2002; Clendon *et al.*, 2004), so the nutrient release from old biomass is spread out as long as four years instead of two (this option being suited only to areas where basal stem rot caused by *Ganoderma* is not endemic);

(d) Reduction of other additional nutrient inputs (inorganic fertilizers, EFB); and

(e) Removal of at least a portion of the old biomass (preferably the trunks) from the replant field for application in mature palm areas where nutrient requirements better match the nutrient release from the biomass.

Source:

Refer to the last printed page of this diary for source.

Source:

Nutrient Management in Oil Palm Replanting

Arif, S., Shahrakbah, Y. and Kee, K.K. 2007. Impact of leguminous covers and palm chips on soil nutrient losses in oil palm replants. Presented at *International Conference on Oil Palm and Environment (ICOPE)*, Bali, Indonesia, preprint 16pp.

Chia, C.C., Lim, C.C., Teo, K.W. and Rao, V. 2002. Oil palm replanting – experiences of underplanting. *The Planter* 78 (914):237-248.

Clendon, J.H., Palat, T. and Corley, R.H.V. 2004. Replanting oil palms in Thailand: underplanting with various thinning and pruning techniques. In: *Proc 4th National Seminar 2004 'Replant or Perish'*, Incorporated Society of Planters, Kuala Lumpur, pp. 95-110.

Corley, R.H.V. 2009. Where do all the nutrients go? *The Planter* 85 (996):133-147.

Hashim, M.T., Teoh, C.H., Kamarudzaman, A. and Ali, M.A. 1995. Zero burning – an environmentally friendly replanting technique. In: Jalani, B.S. et. al. (eds) *Proc 1993 PORIM Int Palm Oil Congress 'Update and Vision*', PORIM, Kuala Lumpur, pp. 185-194.

Khalid, H., Zin, Z.Z. and Anderson, J.M. 1999. Effects of oil palm residues management at replanting on soil nutrient dynamics and oil palm growth. In: Ariffin, D. *et. al*. (eds) *Proc 1999 PORIM Int Palm Oil Congress,* PORIM, Kuala Lumpur, pp. 235-246.

Khalid, H., Zin, Z.Z., Tarmizi, M.A. and Arrifin, D. 2002. Crop residue management during oil palm replanting. *MPOB Technology* 25:1-20.

Lim, K.N., Chee, C.F., Ho, C.Y., Seeveneserajah, K., Ratnam, S. and Mau, J.J. 1995. Mulching immature oil palms with oil palm trunk chippings. In: Jalani, B.S. *et. a*l. (eds) *Proc 1993 PORIM Int Palm Oil Congress 'Update and Vision*', PORIM, Kuala Lumpur, pp. 555-561.

Ooi, L.H. 2011. Agronomic principles and practices of replanting oil palm. In: Goh, K.J., Chiu, S.B. and Paramananthan, S. (eds.) *Agronomic Principles and Practices of Oil Palm Cultivation*, Agricultural Crop Trust, Malaysia, p. 171.

Redshaw, M. 2003. Utilization of field residues and mill by-products. In: Fairhurst, T.H and Härdter, R. (eds) *Oil palm: Management for large and sustainable yields*, PPI/PPIC-IPI, Singapore, p. 308.

von Uexkull, H., Henson, I.E. and Fairhurst, T.H. 2003. Canopy management to optimize yield. In: Fairhurst, T.H and Härdter, R. (eds) *Oil palm: Management for large and sustainable yields*, PPI/PPIC-IPI, Singapore, p. 175.